

CLAIMS

What is claimed is:

1. An energy management system for controlling the temperature of a fuel cell of a vehicle while the vehicle is not running, comprising:
 - a fuel cell stack;
 - a blower that provides air to said fuel cell stack;
 - a water supply;
 - a hydrogen supply;
 - a hydrogen supply valve connected between said hydrogen supply and said fuel cell stack;
 - a heater that is connected to an output of said fuel cell stack; and
 - a controller that controls said hydrogen supply valve and said blower to power said heater to warm said fuel cell stack and said water supply while said vehicle is not running.
2. The energy management system of claim 1, wherein said heater is a resistive heater.
3. The energy management system of claim 1 further comprising:
 - a pressure sensor that generates a hydrogen pressure signal for said hydrogen supply and that is connected to said controller.

4. The energy management system of claim 3 further comprising:
a stack temperature sensor that is connected to said controller and that generates a stack temperature signal.

5. The energy management system of claim 4 wherein said controller determines whether heating is necessary based on said stack temperature if said hydrogen pressure signal exceeds a first pressure value.

6. The energy management system of claim 5 wherein said controller starts said blower and opens said hydrogen supply valve if heating is necessary until said stack temperature signal exceeds a first stack temperature value.

7. The energy management system of claim 4 further comprising:
an ambient temperature sensor that generates an ambient temperature signal;
and
a water tank sensor that generates a water temperature signal.

8. The energy management system of claim 7 wherein said controller uses said stack temperature signal, said ambient temperature signal and said water temperature signal to access a lookup table to determine whether heating is necessary when said pressure signal does not exceed a first pressure value.

9. The energy management system of claim 8 further comprising:
a hydrogen tank level sensor that generates a tank level signal.
10. The energy management system of claim 9 wherein said controller starts said blower and opens said hydrogen supply valve if heating is necessary and if said tank level signal exceeds a first tank level value.
11. The energy management system of claim 10 wherein said controller continues heating until said stack temperature signal exceeds a first stack temperature value.
12. The energy management system of claim 9 wherein said controller activates a purge, drains water from said water supply, and inhibits vehicle startup if said tank level signal does not exceed a first tank level value.

13. An energy management method for controlling the temperature of a fuel cell of a vehicle while the vehicle is not running, comprising the steps of:

providing a fuel cell stack, a blower, a water supply, a hydrogen storage device, a hydrogen supply valve, a heater that is connected to an output of said fuel cell stack, and a controller;

connecting said controller to said hydrogen supply valve, said switch, and said blower and said heater; and

while said vehicle is not running, controlling said hydrogen supply valve, said switch and said blower to generate heat that warms said fuel cell stack and said water supply.

14. The method of claim 13 wherein said heater is a resistive heater.

15. The method of claim 13 further comprising the step of:

generating a hydrogen pressure signal of said hydrogen supply using a pressure sensor that is connected to said controller.

16. The method of claim 15 further comprising the step of:

connecting a stack temperature sensor to said controller; and

generating a stack temperature signal using said stack temperature sensor.

17. The method of claim 16 further comprising the steps of:

determining whether said pressure signal exceeds a first pressure value; and

determining whether heating is necessary based on said stack temperature if
said pressure signal exceeds said first pressure value.
18. The method of claim 17 further comprising the step of:

starting said blower and opening said hydrogen supply valve if heating is
necessary until said stack temperature signal reaches a first stack temperature value.
19. The method of claim 16 further comprising the step of:

connecting an ambient temperature sensor and a water temperature sensor to
said controller;

generating an ambient temperature signal using said ambient temperature
sensor; and

generating a water temperature signal using said water temperature sensor.
20. The method of claim 19 further comprising the step of:

using said stack temperature signal, said ambient temperature signal and said
water temperature signal to access a lookup table to determine whether heating is necessary
if said pressure signal does not exceed a first pressure value.

21. The method of claim 20 further comprising the step of:
connecting a tank level sensor to said controller; and
generating a tank level signal using a hydrogen tank level sensor.
22. The method of claim 21 further comprising the step of:
starting said blower and opening said hydrogen supply valve if heating is
necessary until said stack temperature reaches a first stack temperature value and if said tank
level signal exceeds a first tank level value.
23. The method of claim 21 further comprising the step of:
activating a purge, draining water from said water storage device, and
inhibiting vehicle startup if said tank level signal does not exceed a first tank level value.